

# The U.S. Geological Survey Flagstaff Science Campus

**Providing Expertise on Planetary Science, Ecology, Water Resources, Geologic Processes, and Human Interactions with the Earth**

**T**he U.S. Geological Survey's (USGS) Flagstaff Science Campus is focused on interdisciplinary study of the Earth and solar system, and has the scientific expertise to detect early environmental changes and provide strategies to minimize possible adverse effects on humanity. The Flagstaff Science Campus (FSC) is located in Flagstaff, Arizona, which is situated in the northern part of the State, home to a wide variety of landscapes and natural resources, including (1) young volcanoes in the San Francisco Volcanic Field, (2) the seven ecological life zones of the San Francisco Peaks, (3) the extensive geologic record of the Colorado Plateau and Grand Canyon, (4) the Colorado River and its perennial, ephemeral, and intermittent tributaries, and (5) a multitude of canyons, mountains, arroyos, and plains. More than 200 scientists, technicians, and support staff provide research, monitoring, and technical advancements in planetary geology and mapping, biology and ecology, Earth-based geology, hydrology, and changing climate and landscapes. Scientists at the FSC work in collaboration with multiple State, Federal, Tribal, municipal, and academic partners to address regional, national, and global environmental issues, and provide scientific outreach to the general public.

## Astrogeology Science Center

Established in 1963, the Astrogeology Science Center (ASC) began by supporting the geologic training of the astronauts headed to the Moon. Today, ASC scientists conduct innovative fundamental research across the Solar System as an integral part of the international planetary science community. This research drives where future planetary missions go and the kinds of instruments those missions carry. ASC is also a world leader in developing the software, cartography, photogrammetry, and spatial data infrastructure needed to map planetary bodies.

The maps and tools produced by the ASC are essential for a wide range of activities conducted by the National Aeronautics and Space Administration (NASA), perhaps most notably the landing site selections for the Mars rovers.



**Photographic "selfie" of the Mars Exploratory Rover Curiosity. Photograph provided by NASA.**

## Southwest Biological Science Center

The Southwest Biological Science Center (SBSC) provides expertise in terrestrial and river system biology and ecology in the arid Southwest. SBSC researchers provide data on the ecology and distribution of native and nonnative plants, biological soil crusts, and fish and wildlife species as well as on the consequences of soil disturbance and sediment movement. One area of SBSC research focuses on monitoring the Colorado River ecosystem below Glen Canyon Dam in Grand Canyon National Park, including long-term studies of hydrology, fisheries, and cultural resources. SBSC uses its expertise to provide vital science-based information to partners like the Bureau of Reclamation, Bureau of Land Management, and National Park Service to help manage, conserve, and rehabilitate ecosystems in arid regions.



**Southwest Biological Science Center scientists in the field, investigating biological soil crusts near an automated CO<sub>2</sub> chamber (left) in Arizona, and capturing aquatic insects on the Colorado River (right). Photographs by Jennifer LaVista and Dallana Garcia-Peña, USGS.**



## Arizona Water Science Center

The Arizona Water Science Center (AZWSC) provides essential information on the hydrology of the southern Colorado Plateau, Transition Zone, and Basin and Range physiographic provinces of Arizona, including the effects of dams and diversions of the Colorado River and its tributaries, ground- and surface-water use, as well as water availability and quality. A network of streamflow gages are maintained to monitor base flow of perennial streams, observe extreme hydrologic events such as floods, and measure long-term changes in flow that may be affected by human population growth or climate change. Hydrologic data collected from surface-water (for example the Verde and Colorado Rivers) and groundwater (local and regional aquifers) monitoring sites are provided to the public and to partners responsible for managing water resources. These partners use the data collected by the AZWSC to make science-based decisions for water use and its sustainability in northern Arizona and the southwestern United States.

**Arizona Water Science Center scientists retrieve an instrument that measures water temperature, pH, specific conductance, turbidity, dissolved oxygen, and fluorescence on Lake Powell, Arizona and Utah. Photograph by Dave Anning, USGS.**

## Geology, Minerals, Energy, and Geophysics Science Center

Scientists in the Geology, Minerals, Energy, and Geophysics Science Center (GMEGSC) apply geology-based research to a wide variety of science issues in the western United States. A major research focus of the group is mapping the geology, stratigraphy, and geomorphology of the lower Colorado River corridor (from Hoover Dam to Imperial Dam), where surface water and groundwater provide millions of Americans with water, energy, and recreation. Another focus is documenting and monitoring landscape changes on the Navajo Nation caused by increasing erosion and sediment mobility as a result of drought and land use. For example, GMEGSC scientists have conducted research to better understand the processes of sand-dune migration, which can threaten human health, housing, agriculture, and transportation by changing the amount and location of sand and dust in the air. Detailed geologic data and information maintained by GMEGSC have long-term societal benefits by providing a framework for future studies of hazards, water resources, and land management issues for policy decisions.



**A geologist with the Geology, Energy, Minerals, and Geophysics Science Center hiking in the Bouse Formation near Mesquite Mountain, in western Arizona. Photograph by Phil Pearthree, Arizona Geological Survey.**



**Western Geographic Science Center personnel surveying for Dall sheep in the alpine tundra of Denali National Park, Alaska. Photograph by Dennis Dye, USGS.**

## Western Geographic Science Center

The Western Geographic Science Center (WGSC) conducts research on the environmental and societal consequences of a changing landscape. WGSC develops tools and models to help decision-makers with local and Federal governments better understand complex scientific information so that they can make the best policy decisions possible. For example, WGSC scientists work with the San Carlos Apache Nation in Arizona to help them manage their natural resources by providing training to Tribal staff on remote sensing methods that incorporate data from satellites, light detection and ranging (LiDAR) technology, and unmanned aerial systems. WGSC scientists have also assisted the National Park Service with understanding potential effects of climate change on wildlife habitat in park lands. WGSC scientists apply their expertise globally and have developed 30-meter derived cropland extent maps for places such as Africa, using Landsat satellite images to better understand food and water security issues.

## USGS Library

The Flagstaff Science Campus is home to one of only four branches of the USGS library system. The library's holdings provide one of the most complete collections of materials related to space and planetary research, as well as a sizable inventory of publications relating to Earth science and the geology of the southwestern United States, particularly the Grand Canyon. The library serves USGS scientists and visiting researchers.

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